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The bibliography is good but needs some additions. A detailed index would add to the usefulness of the paper. This paper, together with the account of the Borkum dunes, may well be taken as a model for future studies of dune areas.

COLLIER COBB

A TEXTBOOK OF SEISMOLOGY

CHARLES DAVISON. **A Manual of Seismology.** xi and 256 pp.; maps, diagrs., ills., index. (Cambridge Geological Ser.) The University Press, Cambridge, 1921. 8½ x 6 inches.

Dr. Davison's contributions to the study of earthquakes are well known, and we welcome this volume from him. His "aim has been to give an outline of our present knowledge" of the subject; and this he has accomplished very well. He has given clear accounts of the principle of seismographs, of the nature of earthquake motion, of the propagation of the disturbance, of the geographical distribution of earthquakes—in short, of earthquake phenomena in general. Students of seismology will miss a discussion of the underlying principles of the subject and of its many still unsettled problems; but the length of the book and the general purpose of the series to which it belongs make this impossible. A few ideas are expressed with which the reviewer does not agree; for instance, Davison's conceptions of twin earthquakes. He supposes two fractures of the rock, at points not far apart, to take place within an interval of time so short that the second fracture could not be influenced by the vibrations from the first. Much stronger evidence than we have is necessary to establish so improbable a coincidence. In common with some other seismologists he thinks the buckling of railroad lines in Baluchistan at the time of the earthquake in 1892 indicated a compression of the earth's crust; whereas it was shown in the report of the California earthquake of 1906 that the movement on the fault caused just such an apparent compression without any reduction of the area of the region. Davison regards the first appearance of seismic sea waves at the shore as a depression of the water; this is certainly very general, but there are many instances where the elevation of the water occurs first. The destructive effects of earthquakes on houses and other structures are not treated, probably for lack of space and because these effects may be considered as belonging to applied seismology rather than to the pure science itself.

HARRY FIELDING REID

A NEW ESTIMATE OF OCEAN DEPTHS

ERWIN KOSSINNA. **Die Tiefen des Weltmeeres.** 70 pp.; diagrs. *Veröffentl. des Inst. für Meereskunde*, N. F., A. (Geographisch-naturwissenschaftliche Reihe), Heft 9. E. S. Mittler & Son, Berlin, 1921. 10½ x 7 inches.

This is the latest of the many attempts to estimate the mean depth of the ocean. There are no new methods devised, but the work has evidently been very painstaking, and the results are probably very near the truth. Groll's equivalent-area maps of the oceans, corrected by additional observations made since they appeared, are the basis of the work. The method used was to print Groll's bathymetric lines on paper ruled to square millimeters, and to count the number of square millimeters between successive lines, estimating to tenths. This was done for areas 5° on the side, over all the oceans, and checked by counting the millimeters in each area as a whole. The area corresponding to one square millimeter was not determined by the scale of the map, but by dividing the area between the bounding parallels and meridians, as calculated on a Bessel's spheroid, by the total number of square millimeters counted in it. By this means errors due to inaccuracies in ruling the paper, or to shrinkage or expansion, were avoided. The errors that could not be avoided are due to inaccuracies of the maps and to lack of data for even large areas of the oceans, but it is not likely that Kossinna's results will be materially affected when these deficiencies are made up. The mean depth that he deduces for all the oceans is 3,800 ± 100 meters, somewhat greater than the best estimates made earlier. His measures can evidently be used for other purposes; for instance, to determine the ratio of land and water on the globe. This he finds to be 1 : 2.43; agreeing with Krümmel and differing somewhat from Wagner (1 : 2.54). He also applies his measures to find the ratio of land to water in the northern and southern, the land and the water, hemispheres, and to determine the areas and mean depths of all the oceans and seas of the earth. He combines with

his own measures the estimates of the mean heights of the continents and islands, given by other investigators, to draw a hypsometric curve, and to deduce the mean level of the solid crust, which he finds to be 2,440 meters below sea level. The paper is full of tables giving much information of the kind mentioned above and will be very useful to those interested in this line of earth science.

HARRY FIELDING REID

A MANUAL OF MAP PROJECTION

C. H. DEETZ AND O. S. ADAMS. **Elements of Map Projection with Applications to Map and Chart Construction.** 163 pp.; maps, diagrs., index. *U. S. Coast and Geodetic Survey Special Publ. No. 68*, Washington, D. C., 1921. 50 cents. $11\frac{1}{2} \times 7\frac{1}{2}$ inches.

This is, primarily, a working manual on map projections. Part I deals with the theory involved in representing a curved surface on a plane and explains in simple language the underlying principles of several of the more common projections. Part II deals with the practical construction of these projections and includes detailed instructions as well as the necessary tables, in most cases. The mathematical development of a few of the projections is given for the benefit of those who may wish to see how the formulae are derived; but otherwise the entire book is of an elementary nature and does not require a knowledge of higher mathematics for a full appreciation of its contents.

In Part II the following projections are treated in separate chapters: Polyconic, Bonne, Lambert zenithal equal-area, Lambert conformal conic, Albers conical equal-area, Mercator, and gnomonic. In addition, there is a chapter on world maps where various other projections are treated including the stereographic, Aitoff equal-area, Mollweide homalographic, Goode's homalographic (interrupted), Guyou's doubly periodic, and others. A comparison of several of these projections as regards the amount and location of the maximum distortion shown by illustration in the frontispiece.

The chapter on the polyconic projection includes a discussion of the transverse polyconic projection and the polyconic projection with two standard meridians as used for the International map of the world (tables for the polyconic projection are given in *U. S. Coast and Geodetic Survey Special Publication No. 5*).

Considerable interest attaches to the chapter on the Lambert conformal conic projection on account of the uses made of this projection during the World War. For a small country like France the projection is an ideal one on which to superimpose a grid or quadrillage system. For larger countries, such as the United States, the distortion of this projection becomes too great for military purposes, and some other projection or device must be used. The solution of this problem for the United States is explained in the chapter entitled "The Grid System of Military Mapping."

In many ways the best projection for a general base map of the United States or other large countries with a predominating east and west dimension, is the Albers conical equal-area projection, on account of the small scale distortion and because of other desirable properties. As explained in the chapter on this projection, it is very easy to construct, requiring only good judgment in the selection of the standard parallels.

Navigators will be especially interested in the chapter on the Mercator projection which includes Mercator tables. Considering the extensive use of this projection for charts, it deserves to be better understood and appreciated than is the case at present. The chapter on the gnomonic projection will also appeal to navigators on account of the special properties of this projection, which make it so useful as an adjunct to certain sailing charts and for charts on which to plot radio-compass bearings.

C. H. SWICK

DANISH RAINFALL MAPS

KURT LEHMANN-TEGEL. **Regenkarten des Königreichs Dänemark.** 26 pp.; maps, diagrs., bibliogr. Dietrich Reimer (Ernst Vohsen), Berlin, 1919. M. 6. $12\frac{1}{2} \times 9\frac{1}{2}$ inches.

Denmark is a small country, but with its irregular coast line, its numerous bays and peninsulas, and its outlying islands it presents, within a limited area, a considerable variety of climatic conditions. The new rainfall maps are based on observations at about 200 stations. The basic period is 1876-1915. Reductions to the uniform period, together with certain interpolations, have been made. The isohyets on the mean annual map are